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1. Your reference

A04/B01

2. Patent application number
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0300798.6

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Action Information Technologies Limited

1 Butler Road, Kingsland, Shrewsbury, Shropshire, SY3 7AJ, United Kingdom

Patents ADP number *(if you know it)*

8543217001

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

4. Title of the invention

Data input system

5. Name of your agent *(if you have one)*

Ken Targett

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

48 Meadowsweet Way, Horton Heath, Hampshire, SO50 7PD

Patents ADP number *(if you know it)*

06777791001

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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11. I/We request the grant of a patent on the basis of this application.

Signature K. J. Targett Date 10 January 2003

12. Name and daytime telephone number of person to contact in the United Kingdom: Ken Targett. Tel: 023 8060 1386

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TITLE

Data input system

DESCRIPTION

This invention relates to a data input system and to an electronic apparatus (such as a mobile telephone, PDA or computer) having such a data input system.

Conventionally a computer uses a QWERTY keyboard of twenty-six or more keys. This keyboard uses a separate key for each letter of the alphabet "A" to "Z" and may also use separate keys for numbers "0" to "9", and for various punctuation marks and to control modes. Figure 1 shows a typical layout. The layout of the alphabet keys derives from the earliest mechanical typewriters. The QWERTY keyboard uses different modes to access different characters from the same key. Typically a shift mode is used to access letters of the other case and additional punctuation marks. The usability of the computer QWERTY keyboard has the following drawbacks. Firstly, the requirement for separate keys for each letter means that there needs to be a minimum of twenty-six keys and in practice often many more together with the practical requirement that the keys need to be spaced far enough apart to be individually activated, which implies a minimum size to the overall keyboard. This minimum size may not be accommodated in small devices. Secondly, the arrangement of the letters is not a natural one, and significant learning and practice are required to become familiar with the layout. The ability to use a QWERTY keyboard without looking (touch typing) is considered a recognisable skill and qualification. Many users never become fully familiar with the layout and rely on visual inspection to locate the correct key. Thirdly there is no built-in means for moving the cursor (which indicates the insertion point when inputting) and requires separate cursor control pad or pointing device such as a computer mouse or a touch sensitive area.

Conventionally a mobile telephone uses a numeric keyboard with 10 or more keys. This keyboard uses a separate key for each number "0" to "9". Figure 2 shows a typical layout. When the device is in text mode, each key may be used to generate a number of different characters by pressing the key a number of times within a short time interval. The assignment of the letters "A" to "Z" to the number keys "0" to "9" is based on the alphabet sequence and each number key may have zero or three or four different letters assigned to it. The usability of the mobile telephone numeric keyboard has the following drawbacks. Firstly, the requirement for separate keys for each number means that there needs to be a minimum of ten keys and in practice often more together with the practical requirement that the keys need to be spaced far enough apart to be individually activated, which implies a minimum size to the overall keyboard. This minimum size may not be

accommodated in very small devices. Secondly, the assignment of multiple letters to each key means that a key may need to be pressed up to four times to obtain one letter of the alphabet. In addition, when the next letter required is allocated to the same key as just used then input must be paused to differentiate between a repeat press to select a different letter and a new press to select the next letter. This slows the input speed to the device. Thirdly, the assignment of the letters to the number keys requires learning and practice to become familiar with the layout. Many users never become fully familiar with the layout and rely on visual inspection to locate the correct key. Fourthly there is no built-in means for moving the cursor (which indicates the insertion point when inputting) and requires separate cursor arrow keys or pointing device such as a touch sensitive area.

Some attempts have been made in the past to reduce the number of keys required for inputting the English alphabet to less than twenty-six, while not requiring more than one operation of a key to input at least some of the letters. Patent document US-A-2002/0140679 describes a keyboard in which rocker switches can each be depressed to the left, to the right or centrally to input three letters. It is therefore necessary to use nine rocker switches to represent all 26 letters of the English alphabet. Also, patent document WO-A-02/063455 describes an alphanumeric keyboard in which each number key is formed as a joystick that can also be moved up, down, left and right to input four letters. With this arrangement it is necessary to employ ten joysticks in order to represent all twenty-six letters of the English alphabet and the ten digits.

The aim of the present invention is to provide a data input system that does not require as many as nine or ten user-operable input elements in order to enable the letters of an alphabet to be represented.

In accordance with the present invention, there is provided a data input system comprising at least four input elements, each having a normally-unactuated state and each being manually actuable to each of at least eight momentarily-actuated states; and a decoder operable in an alphabetic mode in which the decoder is operable to interpret each of a first number of the actuated states, equal to the number of letters in an alphabet, as representing a respective letter of that alphabet. Each input element may be used to select at least eight values by a single actuation and so a keyboard comprising four input elements may select at least thirty-two values. Thus a keyboard layout of just four input elements may be used to represent, for example, the twenty-six letters A to Z of the English alphabet and at least six other values. Consequently the overall size may be considerably smaller than an arrangement using more keys given the same spacing between keys.

Preferably, the decoder is also operable in a numeric mode in which the decoder is operable to interpret each of a second number of the actuated states, equal to the number of digits in a number system, as representing a respective digit of that number system. In this case, at least some of the actuated states of the second number of actuated states are preferably identical to the actuated states of the first number of actuated states. Thus an input element's actuated states may be shared between modes and so individual actuated states are not required for both alphabetic and numeric modes separately. When not in the numeric mode, the decoder preferably is operable to respond to one of the actuated states to change to the numeric mode. The use of an otherwise unallocated actuated state means that a separate additional mechanism (such as a dedicated shift key) to select the numeric mode is not required.

Preferably, the first-mentioned alphabetic mode is an upper-case mode in which the decoder is operable to interpret each of the first number of actuated states as representing a respective upper-case letter of the alphabet, and the decoder is also operable in a lower-case mode in which the decoder is operable to interpret each of the first number of actuated states as representing the respective lower-case letter of the alphabet. When not in the lower-case mode, the decoder preferably is operable to respond to one of the actuated states to change to the lower-case mode. Again this means that no additional mechanism is required to select this mode.

Similarly, when not in the, or the upper-case, alphabetic mode, the decoder is preferably operable to respond to one of the actuated states to change to the, or the upper-case, alphabetic mode. Once again this means that no additional mechanism is required to select this mode.

Preferably, the, or at least one of the, mode-changing actuated states, is a ninth actuated state of one of the input elements. This makes the mode selecting actuation distinctive.

Preferably, each input element is manually changeable to said eight actuated states by actuation in eight generally equi-angularly spaced directions, for example by the use of an eight-way joystick. Preferably, said four input elements are arranged in a two-by-two array of a left column, a right column, a top row and a bottom row. This is a compact arrangement that proves convenient to operate for example by one or both thumbs and enables further advantages detailed below. In this case, said eight actuation directions of each input element are preferably the orthogonal left, up, right and down directions, and the four diagonal directions therebetween.

When in the, or either, alphabetic mode, the decoder is preferably operable to interpret the actuation of two of the input elements when actuated in directions with a common orthogonal component as representing vowels, for example "A", "E", "I", "O" and "U" in the English alphabet, or "A", "E", "I", "O", "Υ" and "Ω" in the Greek alphabet. This places the vowels'

actuated states in a line from which it is easy to evaluate the positions of other letters by knowing the sequence of the letters in the alphabet. In the case of the English alphabet, more particularly, when in the, or either, alphabetic mode, the following actuation directions of two of the left input elements are preferably interpreted as the vowels as follows: top left input element, left and up diagonal actuation direction - "A"; top left input element, left orthogonal actuation direction - "E"; top left input element, left and down actuation direction - "I"; bottom left input element, left and up diagonal actuation direction - "O"; and bottom left input element, left orthogonal actuation direction - "U". This places the vowels in alphabetic order down the leftmost side and allows for the placing of the rest of the letters of the alphabet in sequence across the rows. This facilitates the user becoming quickly familiar with the layout and being able to locate the position of the actuated state corresponding to any letter by the simple knowledge of the order of the letters in the alphabet and without the necessity to rely on visual inspection.

In the, or either, alphabetic mode, the decoder is preferably operable to interpret repetition of a particular actuated state within a predetermined period of time as at least two variants of the letter represented by that actuated state, one of the variants being the respective double-letter.

In the case where the number system is the denary number system, preferably at least one of the input elements has nine actuated states, and, in the numeric mode, the decoder is operable to interpret those actuated states as representing the digits "1" to "9". This allows all the non-zero digits "1" to "9" to be represented by a single input element.

Preferably, the decoder is operable, in for example the numeric mode, to interpret said eight actuated states of one of the input elements as representing control commands to move a cursor up, up-right, right, down-right, down, down-left, left and up-left, respectively. This allows the eight cursor directions to be represented by a single input element, and preferably by one of said four input elements.

Preferably, said four input elements are colour-coded. For example, the colour-coding may be blue, yellow, green and red. This may be used in other modes to identify input elements with correspondingly coloured items shown on the apparatus' display, for example to select one of a number of colour coded options or to control one of a number of colour coded objects.

A specific embodiment of the present invention will now be described, purely by way of example, with reference to Figures 3 to 7C of the accompanying drawings, in which:

Figure 1 shows a layout of a conventional computer QWERTY keyboard;

Figure 2 shows a layout of a conventional mobile telephone numeric keyboard;

Figure 3 shows a layout of a data input pad of the embodiment of the invention;

Figure 4 is a schematic isometric view, on a larger scale, of a mobile telephone having the data input pad of Figure 3;

Figure 5A is a horizontal cross-section of a nine-way joystick used in the data input pad of Figure 3;

Figure 5B is a vertical slice cross-section the nine-way joystick of Figure 5A;

Figure 6 is a schematic block diagram of the mobile telephone of Figure 4;

Figure 7A shows an example layout for an uppercase alphabetic mode of the data input pad;

Figure 7B shows an example layout for lowercase alphabetic mode of the data input pad; and

Figure 7C shows an example layout for numeric mode of the data input pad.

Referring to Figures 3 to 6, a mobile telephone 10 has a data input pad 12 disposed on its front face below a display 14 of the telephone 10. The data input pad 12 has a 2x2 array of joysticks 16 (individually referenced 16nw,16sw,16se,16ne), each forming part of a respective switch array 18 (individually referenced 18nw,18sw,18se,18ne). Referring in particular to Figures 5A and 5B, each switch array 18 comprises eight normally-open momentary push-switches 20 equi-angularly arranged around the joystick 16 and a ninth normally-open momentary push-switch 22 to which the lower end of the joystick 16 is joined by an elastic hinge 24. Accordingly, when the joystick 16 is tilted up, down, left, right, up-and-left, up-and-right, down-and-left, and down-and-right (as shown by the arrows around the joystick 16nw in Figure 3), it will close a respective one of the eight switches 20. Furthermore, when the joystick 16 is pressed in (as indicated by the vertical arrows in Figure 4), it will close the switch 22. When the user lets go of the joystick 16, it automatically returns to its central position in which none of the switches 20,22 is closed.

Referring in particular to Figure 6, the mobile telephone 10 also includes a main circuit 26 including a microprocessor 28 and memory 30, to which the display 14, a battery 32, an aerial 34, a microphone 36, a speaker 38 and optionally other switches and indicators 40 are connected in a conventional fashion. The main circuit 26 further includes a decoder 42, part of the functionality of which is provided by the microprocessor 28 and memory 30, to which the switch arrays 18 of the data input pad 12 are connected.

During data input, the decoder 42 and microprocessor 28 are programmed by the memory 30 so as to be operable selectably in an uppercase alphabetic mode, a lowercase alphabetic mode and a numeric mode, in which operation of each of the switches 20,22 of the switch arrays 18 can be interpreted by the decoder 42 to represent different characters or functions.

Figure 7A shows how operations of the joysticks 16nw,16sw,16se,16ne of the four switch arrays 18nw,18sw,18se,18ne are interpreted in the uppercase alphabetic mode. The top left joystick 16nw is shown surrounded by eight of its on positions of the respective switches 20, the up-and-left position being interpreted as the uppercase letter "A", the up position being interpreted as the letter "B" and so on with the up-and-right position, left position, right position, down-and-left position, down position and down-and-right position being interpreted as the uppercase letters "C", "E", "F", "I", "J" and "K", respectively. Similarly, eight of the on positions of the top-right joystick 16ne are interpreted as the uppercase letters "D", "G", "H", "L", "M" and "N" and the punctuation marks apostrophe and hyphen "'", "-". Eight of the on positions of the bottom-left joystick 16sw are interpreted as the uppercase letters "O", "P", "Q", "U", "V", "Y" and "Z" and the full-stop punctuation mark ".". Eight of the on positions of the bottom-right joystick 16se are interpreted as the uppercase letters "R", "S", "T", "W" and "X", and the comma, space and question punctuation marks ",", " ", "?". Furthermore, pressing the top left joystick 16nw inwards (its ninth on state) is interpreted by the decoder 42 as a request to change to the numeric mode (see Figure 7C). Similarly, pressing the top right joystick 16ne inwards is interpreted by the decoder 42 as a request to change to the lowercase alphabetic mode (see Figure 7B). Pressing the bottom left joystick 16sw inwards is interpreted by the decoder 42 as a "tab" or "next" control command, and pressing the bottom right joystick 16se inwards is interpreted by the decoder 42 as a "backspace" control command.

Referring to Figure 7B, in the lowercase alphabetic mode the decoder 42 responds to tilting actuations of the joysticks 16nw,16sw,16se,16ne in a manner exactly alike that in the uppercase alphabetic mode except that the letters of the alphabet are interpreted as lowercase letters "a" to "z" rather than the corresponding uppercase letters "A" to "Z". Also, pressing the joysticks 16nw,16sw,16se inwards has a similar effect as in the uppercase mode. However, pressing the top right joystick 16ne inwards is interpreted by the decoder 42 as a request to change to the uppercase alphabetic mode (see Figure 7A).

Referring to Figure 7C, for the numeric mode, the top left joystick 16nw is shown surrounded by eight of its on positions, the up-and-left position being interpreted as the digit "1", the up position being interpreted as the digit "2" and so on with the up-and-right position, left position, right position, down-and-left position, down position and down-and-right position being interpreted as the digits "3", "4", "6", "7", "8" and "9", respectively. Pressing the top left joystick

16nw inwards is interpreted by the decoder 42 as the digit "5". The up position of the bottom left joystick 16se is interpreted as the remaining digit "0", and the other tilting positions of that joystick are interpreted as various punctuation marks, other characters or mathematical operators. The eight tilting positions of the top right joystick 16ne are interpreted by the decoder 42 as cursor movement commands in the corresponding directions, so as to move a cursor on the display 14, or, for example to navigate a menu, or hierarchical structure of menus, of options. Pressing the top right joystick 16ne inwards is interpreted by the decoder 42 as a request to change to the alphabetic mode in the case last used (see Figure 7A or 7B), or the uppercase mode if neither alphabetic mode has previously been used. The eight tilting positions of the bottom right joystick 16se are interpreted by the decoder 42 as various punctuation marks and a space. Pressing the joysticks 16sw,16se inwards has a similar effect as in the alphabetic modes.

It will be appreciated from Figures 7A and 7B that the positions for the vowels A, E, I, O and U and the partial-vowel Y are aligned, in order, on the left side of the data input pad, that the consonants following a vowel are in order in the same row as that vowel, and that the positions for a particular letter are identical in the two alphabetic modes. It will also be appreciated from Figure 7C that the positions for the digits 1 to 9 and for the "*" and "#" symbols correspond to those on a standard telephone keypad. Furthermore, it will be appreciated from Figures 7A to 7C that where a function, control character or punctuation mark occurs in more than one mode, its position is identical in those modes. All of these features will facilitate the learning of touch-using (as in touch-typing) of the data input pad 12.

Many modifications and developments may be made to the embodiment of the invention described above.

For example, for touch-using, the joysticks 16 may be provided on the rear face, rather than the front face, of the telephone 10, behind the display 14, enabling the size of the telephone 10 be reduced. In this case the vowels may be aligned on the right of the data input pad 12, as viewed from the rear.

Although the invention was conceived in connection with miniature data entry devices, the data entry pad may be formed of a much larger size so that it can be used in environments where the operator is required to wear gloves or mittens and cannot reliably or easily operate a conventionally-sized QWERTY or telephone keyboard.

Although the invention was conceived in connection with inputting text it may also be used to control games. In this case, the joysticks 16nw,16ne,16sw,16se may be colour-coded, for

example blue, yellow, green and red, respectively, and used for controlling correspondingly-coloured game objects.

Although the invention was conceived in connection with inputting text, if the joysticks 16nw,16ne,16sw,16se are colour-coded, for example blue, yellow, green and red, respectively, it may also be used to select correspondingly-coloured options or links or text shown on the display 14.

Although the invention was conceived in connection with inputting text it may be used to navigate a menu, or hierarchical structure of menus, of options.

Although the invention was conceived in connection with inputting text it may be used to control the movement of a cursor shown on the display 14.

Although the invention was conceived in connection with mobile telephones and the like (e.g. PDAs and miniature computers), it may also be embodied in other devices, such as television or set-top-box remote controllers or game controllers. In this case, if the joysticks 16nw,16ne,16sw,16se are colour-coded, for example blue, yellow, green and red, respectively, they may be used for, for example, teletext selection or controlling correspondingly-coloured game objects.

The nine-way joysticks 16 may be replaced by nine-way rocker switches. Also, although each switch array 18 has been described above and shown as comprising nine individual, individually-wired, switches 20,22, other arrangements may be employed. For example, the switches may be multiplexed. The eight switches 20 of each array 18 may be replaced by four switches and additional logic circuitry or further intelligence in the decoder 42, or all nine switches 20,22 of each array may be replaced by two potentiometers or strain gauges and further intelligence in the decoder 42.

Particularly in the case where the numeric mode is not required, the ninth way of each switch array 18 may be omitted. In this case, the change between the uppercase and lowercase modes may be controlled, for example, by a separate dedicated shift switch or by the use of the apostrophe position, and the tab and backspace functions may be provided by the question-mark and hyphen positions. Indeed, one of the alphabetic modes may additionally or alternatively be omitted.

The system may be developed to allow the input of accented letters and the like. For example, in the case of the letter "e" (tilting of the top-left joystick 16nw to the left when in the lowercase mode), holding the joystick 16nw in that tilted position for more than a preset time (say

1 s) may be interpreted by the decoder 42 to commence scanning repeatedly through a number of variants (that are displayed on the display 14) until the required variant is reached and the joystick 16nw is released by the user. In the case of the letter "e", the variants may, for example, be "e", "è", "é", "ê", "ë" and "€" before repeating again from "e". Alternatively, a repeated movement of the joystick 16nw to that tilted position within less than a preset time (say 1 s) after the previous movement to that position may be interpreted by the decoder 42 to sequence the character through the possible variants, similarly to repeated presses of keys on some mobile telephones. This may have the advantage that the user can obtain the required form of the character quicker. However, it does have the disadvantage that it may delay a fast user if a double letter ("ee") is required, because two such tilts of the joystick 16nw in quick succession will produce "è", rather than "ee". To deal with this, the double letter form may be provided at the start of the sequence so that in the case of the letter "e", repeated operation of the joystick 16nw to the left in quick succession produces the variants "ee", "è", "é", "ê", "ë" and "€" before repeating again from "e". Variants may also be used with punctuation marks and control commands. For all of the various positions of the joysticks 16, the primary interpretation by the decoder 42 and the variants upon repeated or held operation may be as given in the following table:

Joystick and Colour	Position	Uppercase Mode Figure 7A		Lowercase Mode Figure 7B		Numeric Mode Figure 7C	
		Primary	Variants	Primary	Variants	Primary	Variants
Top-left 16nw Blue	Up-left	A	AA À Á Â Ã Ä Å Æ @	a	aa à á â ã ä å æ @	1	
	Up	B	BB	b	bb	2	
	Up-right	C	CC Ç ¢ ©	c	cc ç ¢ ©	3	
	Left	E	EE È É Ê Ë €	e	ee è é ê ë €	4	
	Press in	numeric mode		numeric mode		5	
	Right	F	FF	f	ff	6	
	Down-left	I	II Ì Í Î Ï	i	ii ì í î ï	7	
	Down	J	JJ Ð	j	jj ð	8	
	Down-right	K	KK	k	kk	9	
Top-right 16ne Yellow	Up-left	D	DD	d	dd	up-left	
	Up	'	"	'	"	up	
	Up-right	-	_	-	_	up-right	
	Left	G	GG	g	gg	left	
	Press in	lowercase mode		uppercase mode		alphabetic mode	
	Right	H	HH	h	hh	right	
	Down-left	L	LL £	l	ll £	down-left	
	Down	M	MM	m	mm	down	
	Down-right	N	NN Ñ	n	nn ñ	down-right	
Bottom-left 16sw Green	Up-left	O	OO Ò Ó Ô Õ Ö Ø	o	oo ò ó ô õ ö ø	*	
	Up	P	PP Þ ¶	p	pp þ ¶	0	
	Up-right	Q	QQ	q	qq	#	
	Left	U	UU Ù Ú Û Ü	u	uu ù ú û ü	/	| \
	Press in	tab or next	enter or OK	tab or next	enter or OK	tab or next	enter or OK
	Right	V	VV	v	vv	=	
	Down-left	Y	YY Ý ¥	y	yy ý ¥	-	
	Down	Z	ZZ	z	zz	+	_
	Down-right	.	: ...	.	: ...	.	: ...
Bottom-right 16se Red	Up-left	R	RR ®	r	rr ®	~	^
	Up	S	SS ß $ §	s	ss ß $ §	@	&
	Up-right	T	TT	t	tt	%	°
	Left	W	WW	w	ww	(	[{ < «
	Press in	backspace	clear or quit	backspace	clear or quit	backspace	clear or quit
	Right	X	XX	x	xx	)	] } > »
	Down-left	,	;	,	;	,	;
	Down	space		space		space	
	Down-right	?	! ¿ ¡	?	! ¿ ¡	?	! ¿ ¡

As is known per se in mobile telephones, the current mode may be indicated on the display 14, for example by "ABC" for the uppercase mode, by "abc" for the lowercase mode, and

by "123" for the numeric mode. Also, the processor 28 may be programmed in certain circumstances (for example when a telephone number is required to be entered) to force a particular mode (for example the numeric mode) and inhibit mode changing via the data input pad 12. Furthermore, the processor 28 may be programmed in certain circumstances (for example if predictive capitalisation is being employed) to force a particular mode (for example the upper case mode at the beginning of a sentence, but lowercase mode elsewhere) but enable the mode to be changed via the data input pad 12.

The embodiment of the invention has been described with reference to the English alphabet. However, the invention may also be used with other alphabets, or selectably with more than one alphabet. For example, the following tables set out example layouts for the Greek alphabet:

Greek Uppercase Mode

A	B	Γ
E	Numeric Mode	Z
I	K	Λ

Δ		
H	Lowercase Mode	Θ
M	N	Ξ

O	Π	P
Υ	Tab (or Next)	Φ
Ω		.

Σ	T	
X	Backspace	Ψ
,	Space	

Greek Lowercase Mode

α	β	γ
ϵ	Numeric Mode	ζ
ι	κ	λ

δ		
η	Uppercase mode	θ
μ	ν	ξ

o	π	ρ
υ	Tab (or Next)	ϕ
ω		.

σ	τ	
χ	Backspace	ψ
,	Space	

Greek Numeric Mode

1	2	3
4	5	6
7	8	9

Up-left Cursor	Up Cursor	Up-right Cursor
Left Cursor	Alphabetic Mode	Right Cursor
Down-left Cursor	Down Cursor	Down-right Cursor

*	0	#
/	Tab (or Next)	=
-	+	.

~	@	%
(	Backspace	)
,	Space	

It will be appreciated that in the Greek uppercase and lowercase modes, six of the vowels, A, E, I, O, Υ and Ω, are aligned on the left of the left joysticks, and the remaining vowel, H, is placed on the left position of the upper-right joystick.

It should be noted that the embodiments of the invention have been described above purely by way of example and that many modifications and developments may be made thereto within the scope of the present invention.

CLAIMS

The reference numerals in the claims are not intended to limit the protection sought or granted.

1. A data input system comprising at least four input elements (16), each having a normally-unactuated state and each being manually actuable to each of at least eight momentarily actuated states, and a decoder (42) operable in an alphabetic mode (Figure 7A) in which the decoder is operable to interpret each of a first number of the actuated states, equal to the number of letters in an alphabet, as representing a respective letter of that alphabet.

2. A data input system as claimed in claim 1, wherein the decoder is also operable in a numeric mode (Figure 7C) in which the decoder is operable to interpret each of a second number of the actuated states, equal to the number of digits in a number system, as representing a respective digit of that number system.

3. A data input system as claimed in claim 2, wherein at least some of the actuated states of the second number of actuated states are identical to the actuated states of the first number of actuated states.

4. A data input system as claimed in claim 2 or 3, wherein, when not in the numeric mode, the decoder is operable to respond to one of the actuated states to change to the numeric mode.

5. A data input system as claimed in any preceding claim, wherein the first-mentioned alphabetic mode is an upper-case mode in which the decoder is operable to interpret each of the first number of actuated states as representing a respective upper-case letter of the alphabet, and wherein the decoder is also operable in a lower-case mode (Figure 7B) in which the decoder is operable to interpret each of the first number of actuated states as representing the respective lower-case letter of the alphabet.

6. A data input system as claimed in claim 5, wherein, when not in the lower-case mode, the decoder is operable to respond to one of the actuated states to change to the lower-case mode.

7. A data input system as claimed in any of claims 2 to 6, wherein, when not in the, or the upper-case, alphabetic mode, the decoder is operable to respond to one of the actuated states to change to the, or the upper-case, alphabetic mode.

8. A data input system as claimed in claim 4, 6 or 7, wherein the, or at least one of the, mode-changing actuated states, is a ninth actuated state of one of the input elements.

9. A data input system as claimed in any preceding claim, wherein each input element is manually changeable to said eight actuated states by actuation in eight generally equi-angularly spaced directions.

10. A data input system as claimed in any preceding claim, wherein said four input elements are arranged in a two-by-two array of left and right columns, and top and bottom rows.

11. A data input system as claimed in claim 10 when dependent on claim 9, wherein said eight actuation directions of each input element are the orthogonal left, up, right and down directions, and the four diagonal directions therebetween.

12. A data input system as claimed in any preceding claim, wherein the alphabet is the English alphabet.

13. A data input system as claimed in claim 12, wherein, when in the, or either, alphabetic mode, the decoder is operable to interpret the actuation of two of the input elements (16nw,16sw) when actuated in directions with a common orthogonal component as representing vowels.

14. A data input system as claimed in claim 13 when dependent on claim 12, wherein, when in the alphabetic mode, the decoder is operable to interpret the following actuation directions of the two left input elements (16nw,16sw) as representing the vowels as follows:

Top left input element, left and up diagonal actuation direction: "A"
Top left input element, left orthogonal actuation direction: "E"
Top left input element, left and down actuation direction: "I"
Bottom left input element, left and up diagonal actuation direction: "O"
Bottom left input element, left orthogonal actuation direction: "U".

15. A data input system as claimed in any preceding claim, wherein, in the, or either, alphabetic mode, the decoder is operable to interpret repetition of a particular actuated state within a predetermined period of time as at least two variants of the letter represented by that actuated state, one of the variants being the respective double-letter.

16. A data input system as claimed in any of claims 2 to 4, or any of claims 5 to 15 when dependent on claim 2, wherein the number system is the denary number system.

17. A data input system as claimed in claim 16, wherein at least one of the input elements has nine actuated states, and wherein, in the numeric mode the decoder is operable to interpret those actuated states as representing the digits "1" to "9".

18. A data input system as claimed in any preceding claim, wherein the decoder is operable to interpret said eight actuated states of one of the input elements as representing control commands to move a cursor up, up-right, right, down-right, down, down-left, left and up-left, respectively.

19. A data input system as claimed in any preceding claim, wherein said four input elements are colour-coded.

20. A data input system as claimed in claim 19, wherein the colour-coding is blue, yellow green and red.

21. A data input system, substantially as described with reference to the drawings.

22. An electronic apparatus such as a mobile telephone, PDA or computer having a data input system as claimed in any preceding claim for inputting data to the apparatus.

TITLE

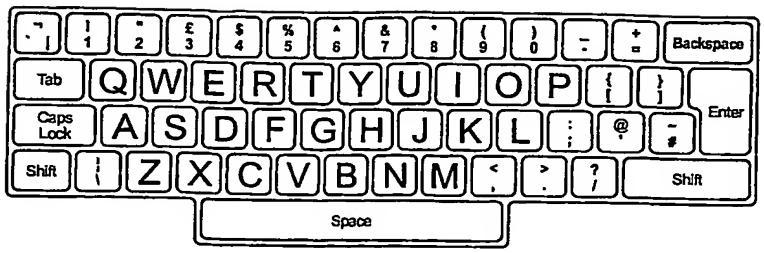
Data input system

ABSTRACT

A data input system comprises at least four input elements (16), each having a normally-unactuated state and each being manually actuable to each of at least eight momentarily actuated states, and a decoder operable in an alphabetic mode in which the decoder is operable to interpret each of a first number of the actuated states, equal to the number of letters in an alphabet, as representing a respective letter of that alphabet. Each input element may be used to select at least eight values by a single actuation and so a keyboard comprising four input elements may select at least thirty-two values. Thus a keyboard layout of just four input elements may be used to represent, for example, the twenty-six letters A to Z of the English alphabet and at least six other values. Consequently the overall size may be considerably smaller than an arrangement using more keys given the same spacing between keys.

Figure 3

Fig. 1



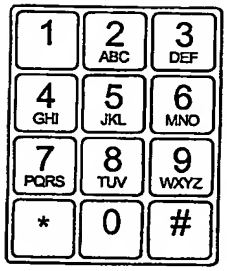


Fig. 2

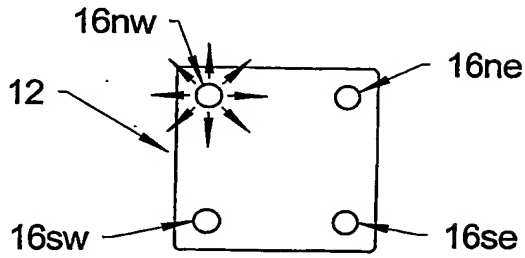


Fig. 3

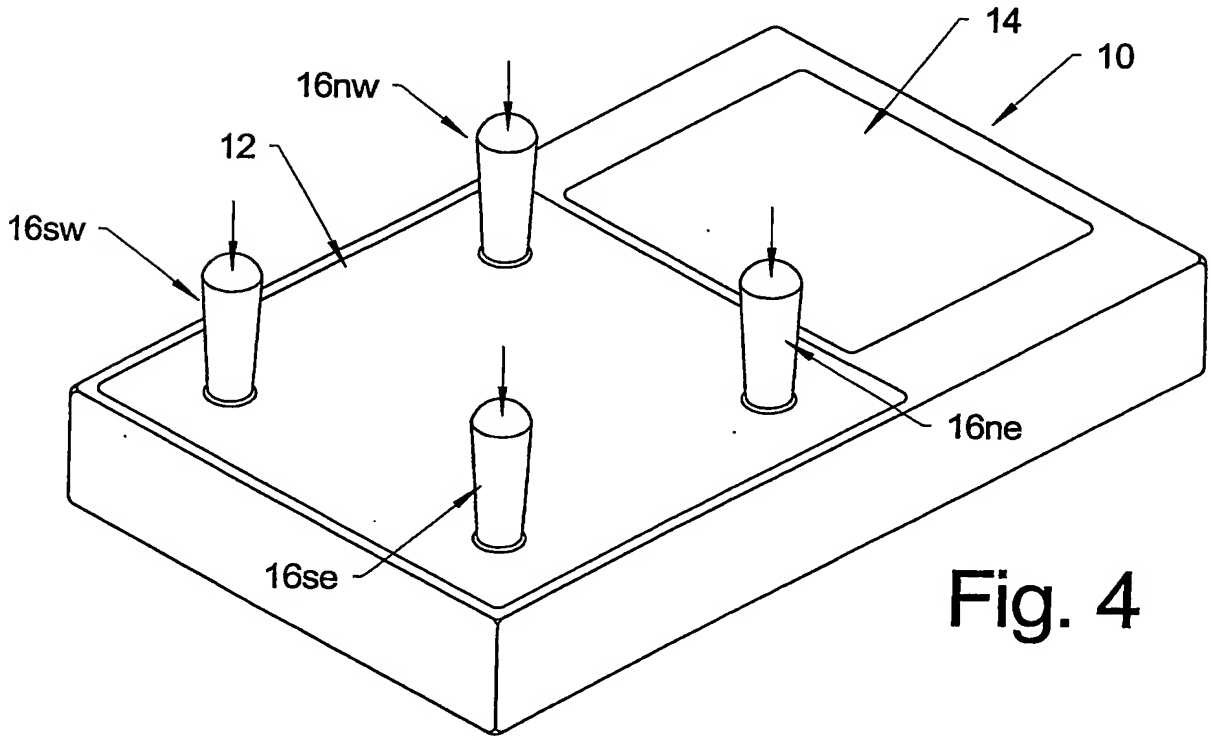
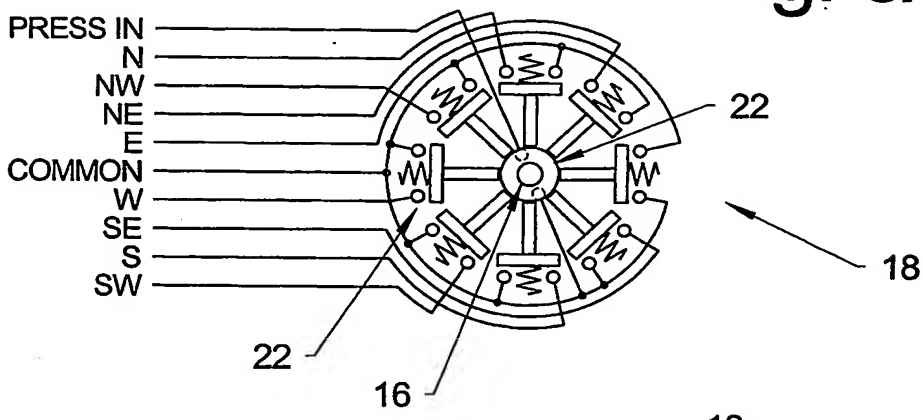


Fig. 4

Fig. 5A



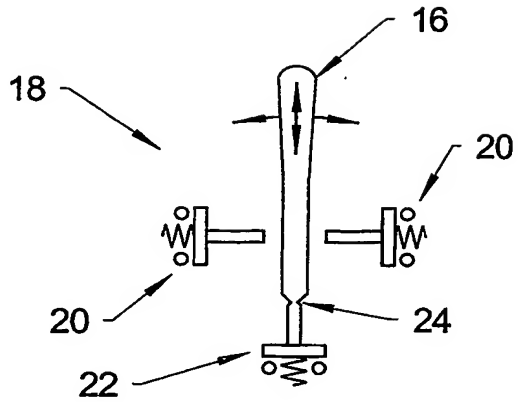


Fig. 5B

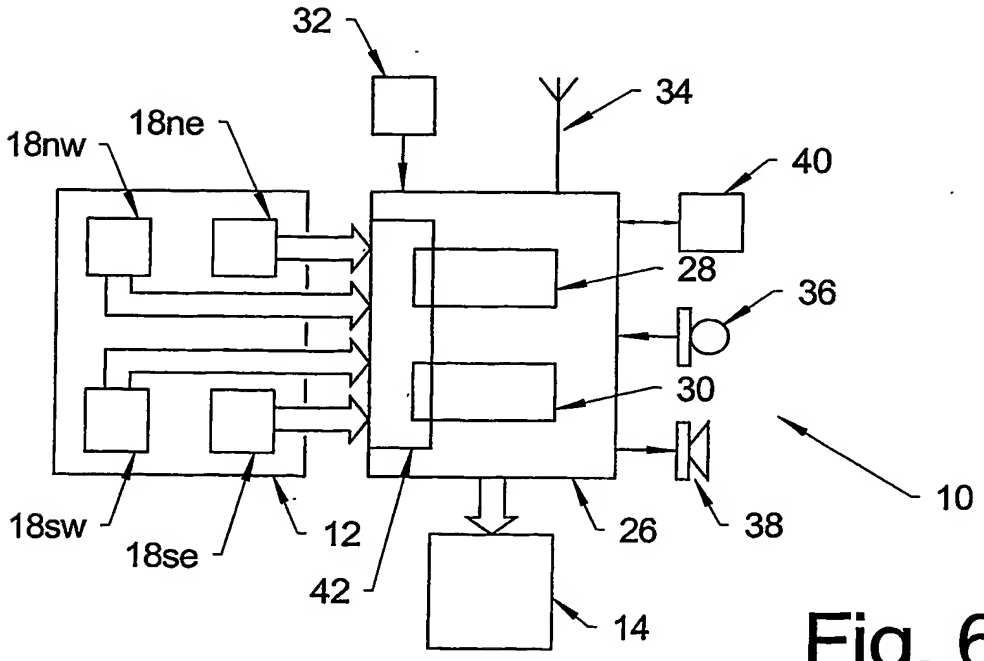


Fig. 6

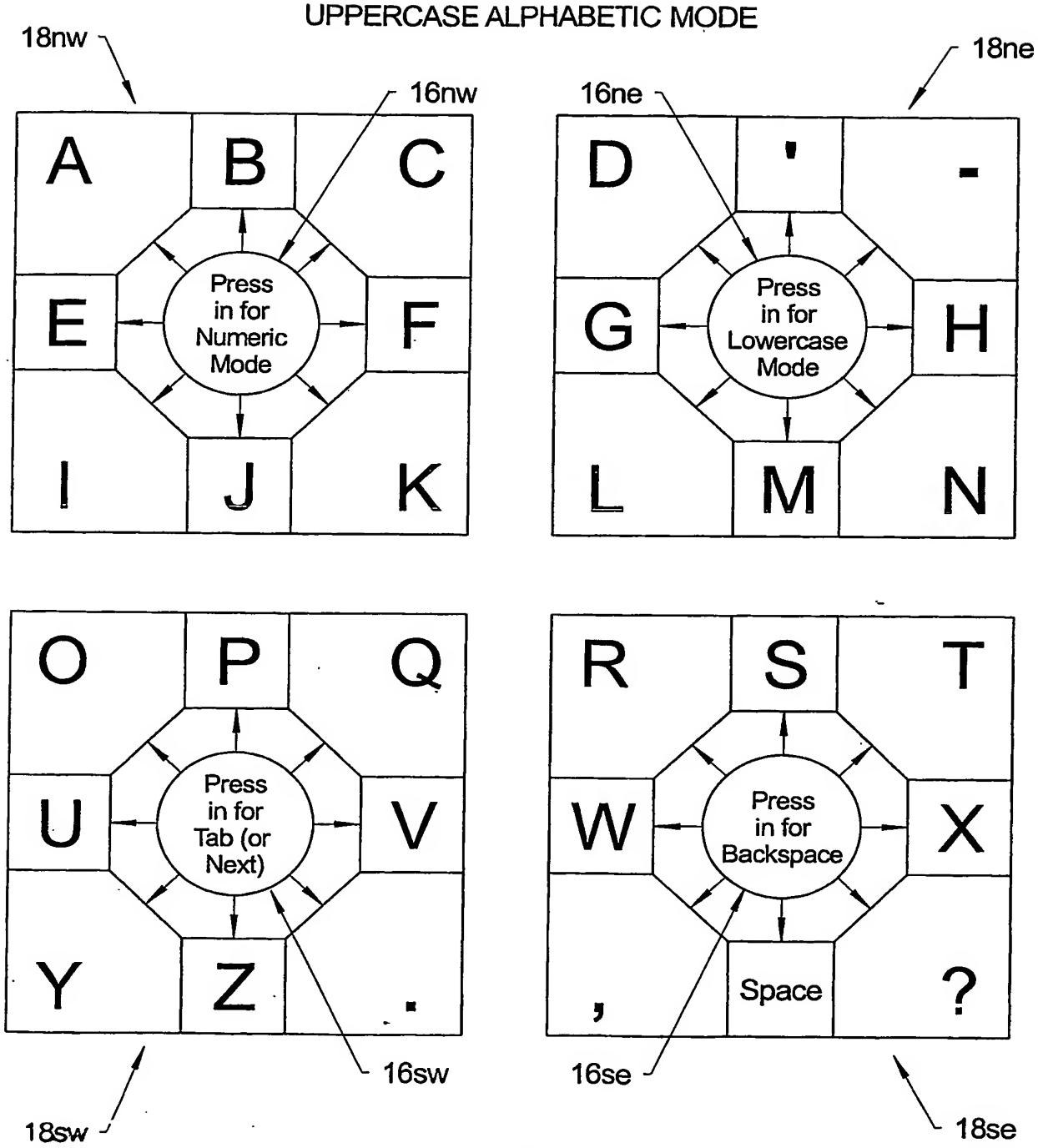

UPPERCASE ALPHABETIC MODE
18nw
16nw
18ne
16ne
A
B
C
D
'
-
E
F
G
H
I
J
K
L
M
N
Press in for Numeric Mode
Press in for Lowercase Mode
O
P
Q
R
S
T
U
V
W
X
Y
Z
.
,
Space
?
Press in for Tab (or Next)
Press in for Backspace
16sw
16se
18sw
18se

Fig. 7A

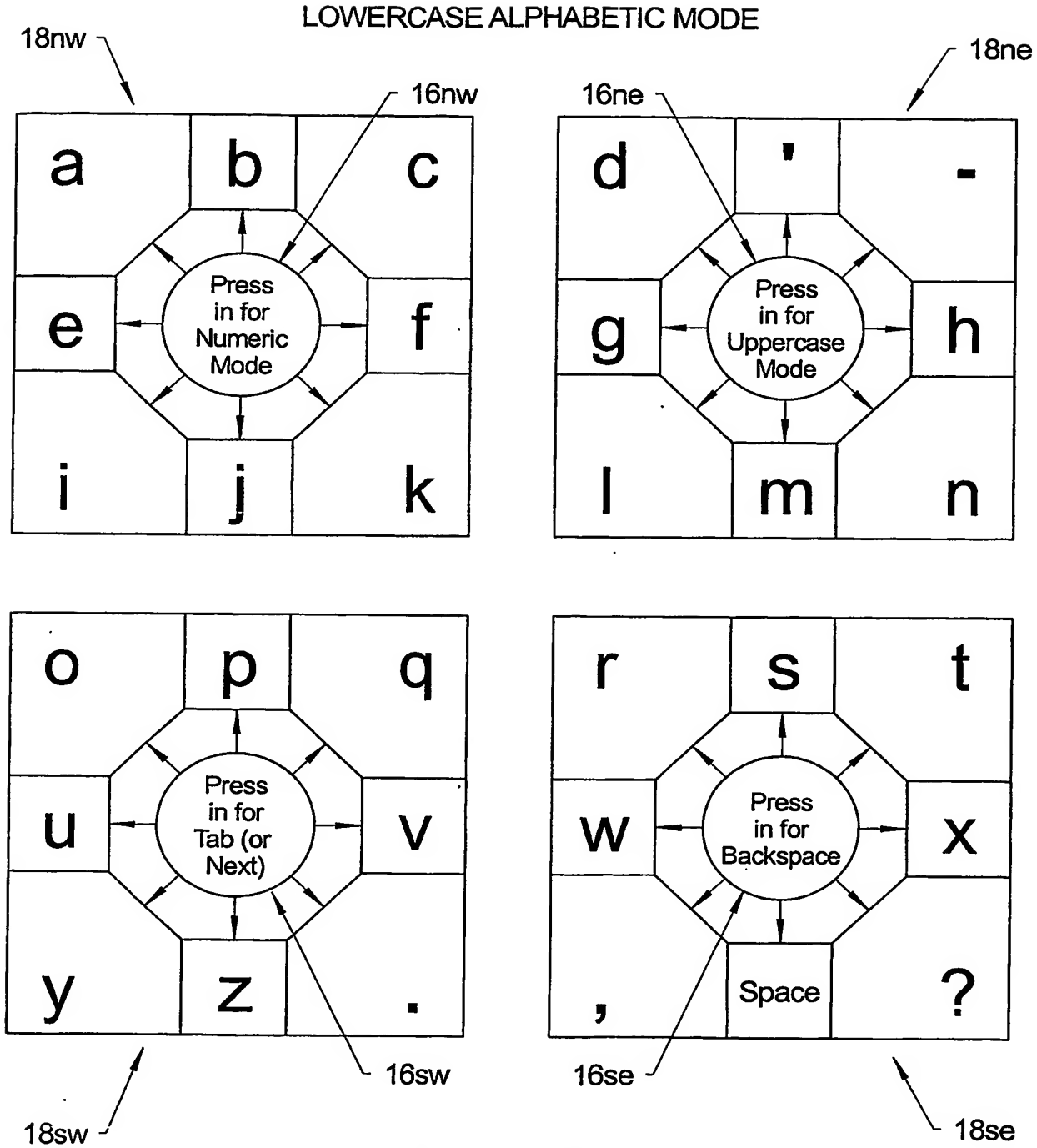

LOWERCASE ALPHABETIC MODE
18nw
16nw
18ne
16ne
a
b
c
d
'
-
e
Press in for Numeric Mode
f
g
Press in for Uppercase Mode
h
i
j
k
l
m
n
o
p
q
r
s
t
u
Press in for Tab (or Next)
v
w
Press in for Backspace
x
y
z
.
,
Space
?
16sw
16se
18sw
18se

Fig. 7B

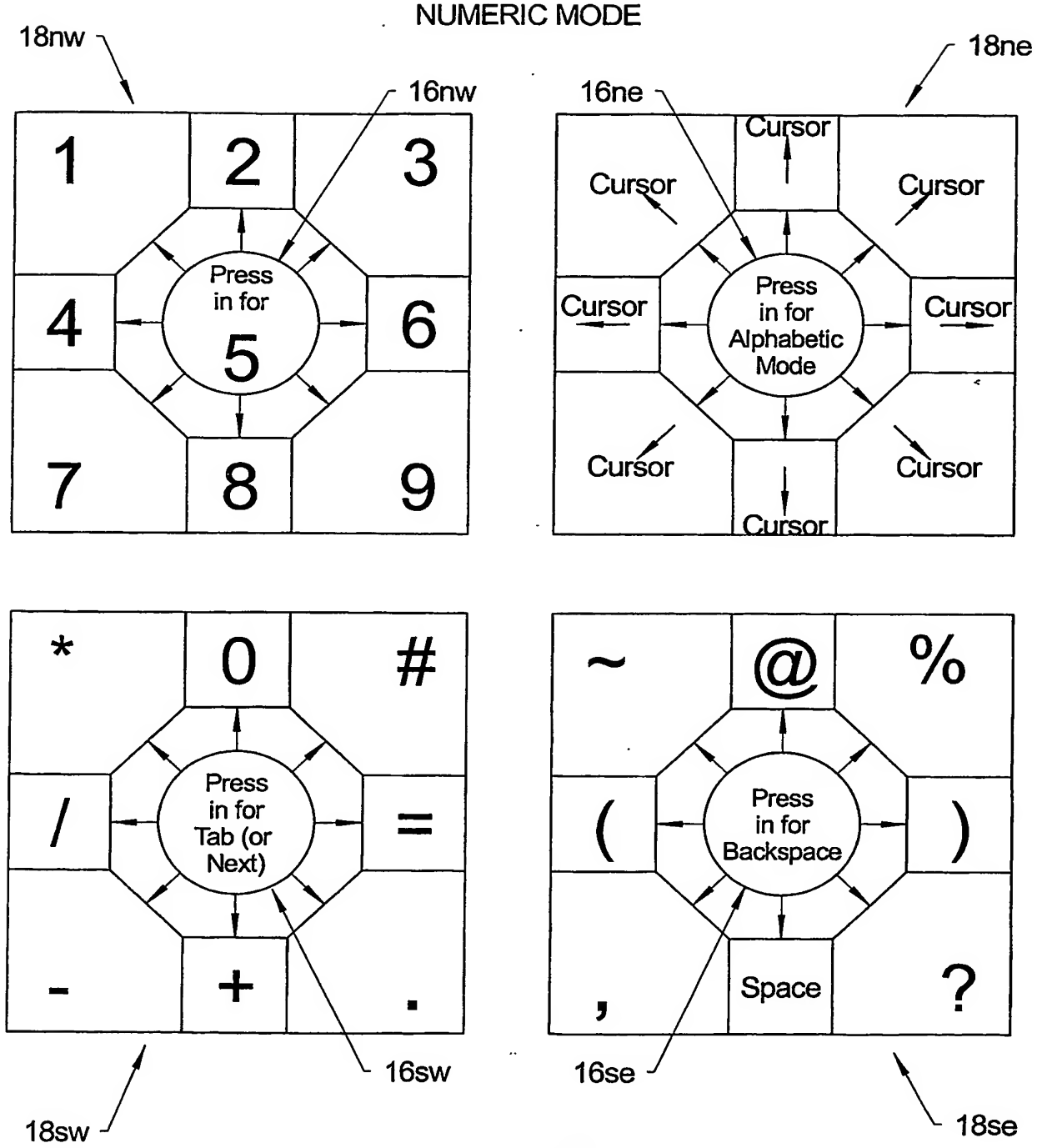

NUMERIC MODE
18nw
16nw
1
2
3
4
Press in for 5
6
7
8
9
18ne
16ne
Cursor
Cursor
Cursor
Press in for Alphabetic Mode
Cursor
Cursor
Cursor
Cursor
*
0
#
/
Press in for Tab (or Next)
=
-
+
.
16sw
18sw
~
@
%
(
Press in for Backspace
)
,
Space
?
16se
18se

Fig. 7C